

## FORAGING BEHAVIOR OF THE ACORN WOODPECKER IN BELIZE, CENTRAL AMERICA

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**ABSTRACT.**—The foraging behavior of the Acorn Woodpecker (*Melanerpes formicivorus*) was observed during the dry season in the Pine Ridge region of Belize. The birds ate a variety of foods commonly consumed by this species in temperate regions, including flying insects, oak sap, and insects obtained by surface gleaning and probing. All birds also stored large numbers of acorns in natural cavities and in woodpecker-modified holes. The woodpeckers' social organization here resembled that found in most temperate habitats. All of the birds observed lived in stable social groups that contained between two and six individuals. No solitary birds were recorded. Although nesting was not studied, it is likely that the birds breed communally in Belize as elsewhere in their range.

The Acorn Woodpecker (*Melanerpes formicivorus*) is a common resident of oak and pine-oak woodlands from western North America southward through Central America to northern Colombia (Ridgway 1914). In temperate habitats, most individuals live in year-round groups that collectively harvest and store acorns as a winter food supply (Bent 1939). The foraging ecology of this species has been examined extensively in North America (Ritter 1929, Bent 1939, MacRoberts 1970, Roberts 1979), but has not been studied in detail elsewhere. The Acorn Woodpecker has been reported to occur in association with oaks throughout Central America and Colombia, yet considerable variation may exist in the extent to which acorns are utilized and/or stored in modified holes. For example, neither Dickey and Van Rossem (1938) in El Salvador, nor Ridgely and Gaulin (1980) in Colombia, found any evidence that this species stored or even fed on the acorns that were present at their respective study areas. Skutch (1969) reported that the Acorn Woodpeckers which he had observed in various parts of Central America did frequently feed on acorns, but that they stored the nuts in natural crevices in the bark of trees and not in individual storage holes. However, he published a photograph of a storage tree that had been found in Honduras, and both Peck (1921) and Russell (1964) reported that this species made storage holes in dead pines (*Pinus* spp.) in Belize (British Honduras).

I examined the foraging behavior of Acorn Woodpeckers during the dry season in a tropical dry forest in Belize. I wished to determine whether or not the birds used acorns in this habitat, the extent to which the nuts were stored, and the relative im-

portance of acorns as a food source. I also studied the social organization of the woodpeckers to determine whether the birds' behavior in this environment differed from that of North American populations studied previously by MacRoberts and MacRoberts (1976), Stacey (1979), Koenig (in press) and others.

### STUDY AREA AND METHODS

My study area was in the Pine Ridge region of Belize, approximately 28 km west of Belize City near the Western Highway. The Pine Ridge is a coastal pine-oak savanna, characterized by gently sloping ridges and a well-drained sandy clay soil. The common trees in this association include Caribbean pine (*Pinus caribaea*), oaks (*Quercus oleoides* and two unidentified species), craboo (*Byrsonima crassifolia*) and palmetto (*Acoelorrhaphes wrightii*). Various sedges (*Rhynchospora* spp.) predominate in open areas. Patches of hardwood forests occur near the banks of several small streams that ran through the study area. These small forests contain many scrubby second growth species as well as larger trees typical of limestone soils throughout the lowland areas of Belize (see Wright et al. 1959, Russell 1964).

I studied Acorn Woodpeckers during 240 observer-hours between 15 February and 6 March 1977. The dry season in Belize normally occurs between February and May. Although rainfall records were not available at the study area, Belize City receives only about 10% of its annual rainfall (185 cm) during the dry season (Russell 1964). I observed the foraging behavior primarily of three groups, obtaining additional data from five other groups in the vicinity. I watched each group during various times of the day, and, where possible, followed individual birds as they moved through their territories. Foraging behavior was divided into six categories described below. An individual was scored as having performed a feeding pattern each time it changed from one bout of a behavior to another bout of the same or different behavior (e.g., Cruz 1977). For example, if a woodpecker was gleaning for insects, it was considered to have made one gleaning bout each time it left one tree and flew to a new tree. Sap eating was also scored in bouts: i.e., each time an individual fed on sap at one site in a particular tree, rather than

each time it probed a hole for sap during one sequence. I made a continuous record of all feeding bouts during each observation period.

The number and sex (Spray and MacRoberts 1975) of the woodpeckers on each territory were determined by observing the birds as they emerged from their roost holes at dawn on at least two separate occasions for each group. These data were then verified by examining the composition and maximum group size while the birds were foraging.

## RESULTS

### FOODS AND FORAGING PATTERNS

Acorn Woodpeckers foraged in five major ways as well as by a few rare methods that I classified separately.

*Storing acorns* (16% of 409 foraging bouts observed). The oaks at the study area generally produce acorns during October and November (William Hasse, pers. comm.). No acorns were present on the oaks when I began the study in February; however, all of the woodpecker groups observed possessed at least some stored acorns on their territories. They stored acorns in two ways. All but one of the eight groups had one or more dead pine trees in their territories in which they had excavated storage holes. These storage trees were generally similar in appearance to those found in temperate regions except that most trees contained only between 20 and 160 holes rather than the thousands of holes that are frequently made by groups in temperate areas (e.g., MacRoberts 1970).

In addition to these primary storage sites, each group had a number of secondary storage locations throughout its territory. These sites had not been modified by the woodpeckers; nuts were placed in natural cracks and cavities in dead branches or trees. Each secondary site contained between 5 and 60 acorns. One group had at least six secondary storage locations, including one that was at the opposite end of its territory from the main storage tree in an area rarely used by the group. The birds also frequently took small pieces of acorns to nearby trees to store in bark or in bromeliads. This behavior effectively dispersed the acorn stores of each group throughout its territory. I never saw any other species of bird or mammal attempt to "rob" acorn stores. However, since the groups were intraspecifically territorial, the stores were defended from other Acorn Woodpeckers.

Owing to the diffuse nature of storage, I could not accurately count the number of acorns that had been stored by each group. Although the birds frequently fed on acorns throughout the study, none of the groups

had exhausted its stores by the end of the study in March.

*Feeding on sap* (18% of total). Two of the three groups that were observed continuously possessed one or more trees on their territories that contained numerous holes from which the birds obtained sap. I could not tell if the other groups also had sap trees. Oaks were the only trees that were used for sap feeding, and each tree examined had at least 50 holes that had been made by the woodpeckers. The holes and sap-eating behavior were similar to those reported in North America (MacRoberts 1970).

*Flycatching* (19% of total). In comparison with many woodpeckers, the Acorn Woodpecker is morphologically well adapted for flycatching. This species has a relatively large wing area and proportionally small wing loading, which improves maneuverability at low speeds (Bock 1970). The birds in Belize frequently flycaught from exposed perches at or near the tops of trees. Only one prey item was captured per sortie. When there was an aerial swarm of insects (probably hymenopterans) all members of the group congregated in one or two trees and made frequent sorties. During these swarms, the woodpeckers were often joined in the same tree by several species of resident flycatchers, including Tropical Kingbirds (*Tyrannus melancholicus*) and Social Flycatchers (*Myiozetetes similis*), as well as Summer Tanagers (*Piranga rubra*) and Tropical Mockingbirds (*Mimus gilvus*). There was little interspecific aggression during the swarm, and once it was over each species dispersed and foraged separately.

*Gleaning* (31% of total). Gleaning, during which an individual searched for invertebrate prey on the surfaces of tree trunks and limbs, was the most common foraging behavior observed. In larger trees, the birds flew to the base of each tree and gradually moved upwards. While foraging in the pines, the woodpeckers used only the lower portions of the tree that were free of dense side branches; after this area had been searched the birds flew to the base of the next pine tree. In oaks and craboo, both the trunk and side branches were covered. The birds also occasionally gleaned from the leaves of oaks and craboo trees.

When foraging in pine stands, the members of a group often moved as a unit. I did not see such coordinated movement at other times, and the birds usually foraged independently of each other.

The Acorn Woodpeckers in Belize never

pecked or excavated subsurface insect larvae in the trees, nor has this behavior been observed in any other population studied to date (e.g., MacRoberts and MacRoberts 1976).

*Probing* (15% of total). This manner of foraging was similar to gleaning, except that instead of searching for prey on the surface of trees or leaves, the bill was inserted into loose material or into rotten stubs of dead branches. The woodpeckers often probed for prey in the tops of the palmetto trees and in bromeliads.

*Other foraging methods* (1% of total). Several rare methods of foraging could not easily be categorized. These included searching and opening a termite nest (one instance), foraging on the ground (once), and eating leaf buds (three cases).

While foraging, the birds used almost exclusively only those species of trees that occurred in the pine-oak association, and rarely entered the patches of hardwood forest that were present on all territories. Of the 165 total observed bouts of gleaning and probing (excluding those on leaves and bromeliads), 37% were in pines, 36% in oaks, 15% in craboo, and 5% in the palmetto. Only three times (2%) did I see foraging in any tree species in the hardwood forests.

#### SOCIAL ORGANIZATION

All of the Acorn Woodpeckers that I observed were either in pairs or in larger groups. I found no territories that were occupied by solitary individuals. Of four groups for which group membership was reliably determined, two contained six birds, one contained five, and one was a male-female pair. Each group occupied an exclusive, all-purpose territory. The territories varied greatly in size, probably due to local differences in the density of oaks and other trees. Some territory boundaries were indefinite because of the presence of open grasslands or hardwood forests, both of which were rarely used by the woodpeckers. However, when the borders of two territories were contiguous, they were vigorously defended against all conspecific intruders. During these disputes, most or all of the resident birds acted together to chase the invading group. There was little aggression among the members of one group, and when two or more individuals landed close together on the same perch, each bird usually gave "waka" or "greeting" displays (see MacRoberts and MacRoberts 1976).

Russell (1964) reported that the Acorn Woodpecker generally breeds in Belize be-

tween mid-March and mid-June. Although I did not see nesting during this study, I recorded behavior in early March which suggested that the groups were in the early stages of breeding. Individual group members frequently entered certain nest holes on their territories, and remained there for long periods. This behavior is frequently associated with choosing a nest hole (Stacey 1979). It is likely that most or all group members remained on the territory and participated in reproduction. Although the birds were not banded, I saw no indication that any of the groups lost or gained members during the study; nor did I note a tendency for group members to spend frequent or prolonged periods away from their territory that would suggest that they were about to disperse prior to breeding. Dora Weyer (pers. comm.), a local ornithologist, observed more than two adult Acorn Woodpeckers feeding young at one nest in a similar habitat approximately 10 km from my study area, and communal breeding has been reported in this species elsewhere in Central America (Skutch 1969).

#### DISCUSSION

Both the social organization and foraging behavior of the Acorn Woodpecker in Belize were similar to those that have been found in other populations of this species in temperate habitats. All of the birds at the study area occurred either in pairs or in larger groups. They did not use any food type or foraging method that has not been observed for this species in North America. Like many melanerpine woodpeckers, the Acorn Woodpecker eats a wide variety of foods. I found no indication that this species forages in a more specialized manner in the tropical environment of Belize than in more northern habitats. In fact, the birds at the study area used all foraging methods with very similar frequencies. Gleaning, which was the most common foraging activity of the birds, is of variable importance for populations in temperate habitats. In New Mexico (pers. observ.) and in central coastal California (MacRoberts and MacRoberts 1976) Acorn Woodpeckers rarely glean, whereas elsewhere in California (Roberts 1979) and in Arizona (Stacey and Bock 1978) they often do so.

All of the groups at the study area possessed large numbers of acorns that they had stored either in holes made by the woodpeckers themselves or in natural cracks and cavities. The birds used the stores as a major food source during the

study period, even though alternative foods, such as flying insects and sap, were available. Food storage has been reported in a number of temperate species, but it appears to be uncommon among tropical birds. While a number of melanerpine woodpeckers store mast in the United States (Bent 1939), the Acorn Woodpecker is the only species known to do so in the tropics. Southern populations of Steller's Jays (*Cyanocitta stelleri*) also may store nuts (Skutch 1960, 1969). Many temperate species are regularly subject to food shortages during the winter, a possibly important factor in the evolution of storing behavior (Roberts 1979; see also Anderson and Krebs 1978). Acorn Woodpeckers in temperate areas use their stores primarily during the winter, when other foods may be scarce or unavailable. Groups that exhaust their stores may abandon their territories and move elsewhere in search of food (MacRoberts and MacRoberts 1976, Stacey and Bock 1978). The fact that Acorn Woodpeckers also store food in a more tropical region, e.g., Belize, suggests either that food is periodically scarce in this environment and/or that this species will store food whenever such behavior is energetically advantageous, that is, when individuals are able to gain more energy from the stores than they expend in creating them.

#### ACKNOWLEDGMENTS

I thank K. Stacey, J. Hoffmann and particularly R. Jansma for their help with the field work. Dora Weyer and William Hasse kindly shared both their hospitality and their knowledge of Belize. S. Altmann, C. Bock, W. Koenig, M. MacRoberts, C. Roberts and R. Troetschler made helpful comments on the manuscript. This work was supported in part by grant DEB 76-10009 from the National Science Foundation.

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